Guidance for $PM_{2.5}$ Permit Modeling

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Background

- Daily and Annual $PM_{2.5}$ NAAQS originally established on July 18, 1997:
  - Daily or 24-hour $PM_{2.5}$ NAAQS was set at 65 $\mu g/m^3$
  - Annual $PM_{2.5}$ NAAQS was set at 15.0 $\mu g/m^3$
- Citing significant technical difficulties with respect to $PM_{2.5}$ monitoring, emissions estimation, & modeling, the U.S. EPA established the PM_{10} Surrogate Policy on October 23, 1997.
  - Allowed permit applicants to use compliance with the applicable PM_{10} requirements as a surrogate approach for meeting $PM_{2.5}$ NSR requirements.

Background *(Continued)*

- The $PM_{2.5}$ NAAQS was revised on October 17, 2006:
  - 24-hour $PM_{2.5}$ NAAQS was reduced to 35 µg/m^3
  - Annual $PM_{2.5}$ NAAQS was retained at 15.0 µg/m^3
- The final rules governing the implementation of the NSR program for $PM_{2.5}$ was promulgated on May 16, 2008.
  - Establishment of the Significant Emissions Rate (SER) for $PM_{2.5}$ and for the $PM_{2.5}$ Precursors which define the rates at which a net emissions increase will trigger major NSR permitting requirements.
    - Direct $PM_{2.5}$ SER = 10 tpy, $PM_{2.5}$ Precursors – NO_x and SO_2 = 40 tpy
- On February 11, 2010, the U.S. EPA published a proposal to repeal the grandfathering provision and an early end to the PM_{10} Surrogate Policy

Background *(Continued)*

- To assist sources and permitting authorities in carrying out the required air quality analysis for $PM_{2.5}$ compliance demonstrations, a guidance memorandum entitled "Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS" was released on March 23, 2010.
  - Often referred to as the "Page Memo."
  - Addressed interim procedures to address the probabilistic / statistical form of the NAAQS.
  - Acknowledged that there are technical complications associated with the ability of existing models to estimate the impacts of secondarily formed $PM_{2.5}$.
  - Recommended special attention be given to the evaluation of monitored background air quality data since this data readily accounts for the contribution of both primary and secondarily formed $PM_{2.5}$.

Background *(Continued)*

- On October 20, 2010, the final rule on $PM_{2.5}$ Increment, Significant Impact Levels (SILs), and Significant Monitoring Concentration (SMC) was promulgated.
  - Please note, aspects of this rule making with respect to SMC and SILs has changed per a January 22, 2013, decision from the U.S. Court of Appeals for the District of Columbia Circuit. More information on this decision will be provided in a subsequent slide.
- EPA engages with NACAA on 3 topic areas related to the modeling $PM_{2.5}$ from single sources.
  - The NACAA $PM_{2.5}$ Modeling Implementation Workgroup shares a final report and recommendations to EPA on January 7, 2011.
- The PM10 Surrogate Policy officially ended on May 16, 2011.
  - PSD compliance demonstrations must now be completed for $PM_{2.5}$, include primary PM2.5 and, if applicable, secondarily formed $PM_{2.5}$ from precursor emissions.

Background *(Continued)*

- On January 4, 2012, the EPA granted a petition submitted on behalf of the Sierra Club on July 29, 2010.
  - In the petition grant, the EPA committed to engage in rulemaking to evaluate updates to the *Guideline on Air Quality Models* as published as Appendix W to 40 CFR 51, and, as appropriate, incorporate new analytical techniques or models for ozone and secondary $PM_{2.5}$.
  - As part of this commitment with the Sierra Club and in compliance with Section 320 of the Clean Air Act, the EPA conducted the 10th Conference on Air Quality Modeling (10th Modeling Conference) was held in March 2012.
    - http://www.epa.gov/ttn/scram/10thmodconf.htm
  - The release of the *Draft Guidance for $PM_{2.5}$ Permit Modeling* is consistent with the EPA's commitments in the January 4, 2012, administrative grant of the Sierra Club petition.

Background *(Continued)*

- The $PM_{2.5}$ NAAQS was revised again on December 14, 2012:
  - 24-hour $PM_{2.5}$ NAAQS was retained at 35 µg/m^3
  - Annual $PM_{2.5}$ NAAQS was reduced to 12.0 µg/m^3
- On January 22, 2013, the U.S. Court of Appeals for the District of Columbia Circuit vacated the SMC for $PM_{2.5}$ and two provisions in EPA's PSD regulations containing SILs for $PM_{2.5}$.
  - SMCs for $PM_{2.5}$ should not be relied upon to exempt applicants from compiling preconstruction monitoring data for $PM_{2.5}$ in accordance with Sections 51.166(m) and 52.21(m) of the EPA's regulations.
  - The EPA believes PSD permit applicants may continue to meet the preconstruction monitoring requirements in these regs. by using data from existing monitors that are determined by the applicable permitting authority to be adequately representative of background conditions.

Background *(Continued)*

- On January 22, 2013, the U.S. Court of Appeals for the District of Columbia Circuit vacated the SMC for $PM_{2.5}$ and two provisions in EPA's PSD regulations containing SILs for $PM_{2.5}$. *(Continued)*
  - The Court's decision does not preclude the use of SILs for $PM_{2.5}$, but requires that EPA correct the error in the SIL regulations for $PM_{2.5}$ at 51.166(k)(2) and 52.21(k)(2).
  - EPA believes that permitting authorities may continue to apply SILs for $PM_{2.5}$ to support a PSD permitting decision, but they should take care to ensure that the SILs are not used in a manner that is inconsistent with the requirements of Section 165(a)(3) of the Clean Air Act.
  - Please reference the *$PM_{2.5}$ SILs/SMC Court Decision Question and Answer Document* for more information on the Court's decision.
    - http://www.epa.gov/nsr/guidance.html

Draft Guidance for $PM_{2.5}$ Permit Modeling

- Publically released on Monday, March 4, 2013.
- Initial 45 day comment period through April 17, 2013 was extended by 45 days through May 31, 2013.
  - Numerous requests to extend the comment period by co-regulators, industry, and environmental groups.
  - The extension through May gave an opportunity for the entire dispersion modeling community to discuss the draft guidance document at the 2013 Regional, State, and Local Modelers' Workshop in Dallas, TX (April 22nd through 25th)
- At the end of the comment period, EPA had received 30 comprehensive comment packages.

Comments Received

- Most of the comments were supportive and positive.
- Earth Justice (Sierra Club) was very critical of our use of SILs throughout the draft guidance given the January 22, 2013 court decision.
- Industrial comments warned that the processes laid out in the draft guidance were complex and would be an additional burden on top of their issues with existing background levels of $PM_{2.5}$.
- Several industry related comments desired a more simplistic (surrogate) approach as was previously policy.

Comments Received *(Continued)*

- A few of the industrial comments were emissions / stack testing related and have been shared with the appropriate groups within EPA.
  - Interim guidance for the treatment of condensable particulate matter test results in the PSD and NSR permitting programs http://www.epa.gov/ttn/emc/methods/psdnsrinterimcmpmemo4814.pdf
- Most of the co-regulating agency comments provided specific feedback along the lines of the NACAA workgroup recommendations.
- Several of the co-regulating agencies desired more prescriptive approaches, especially in the assessment of secondarily formed $PM_{2.5}$.

Guidance for $PM_{2.5}$ Permit Modeling

- The updates to the draft guidance are complete! The finish line has been crossed, but the *race results* are under official review.

- The final version of the guidance document is in the signature chain for Steve Page as I present these slides.

- It is my/our hope that the final guidance can be posted to SCRAM before the completion of the 2014 RSL Modelers' Workshop.

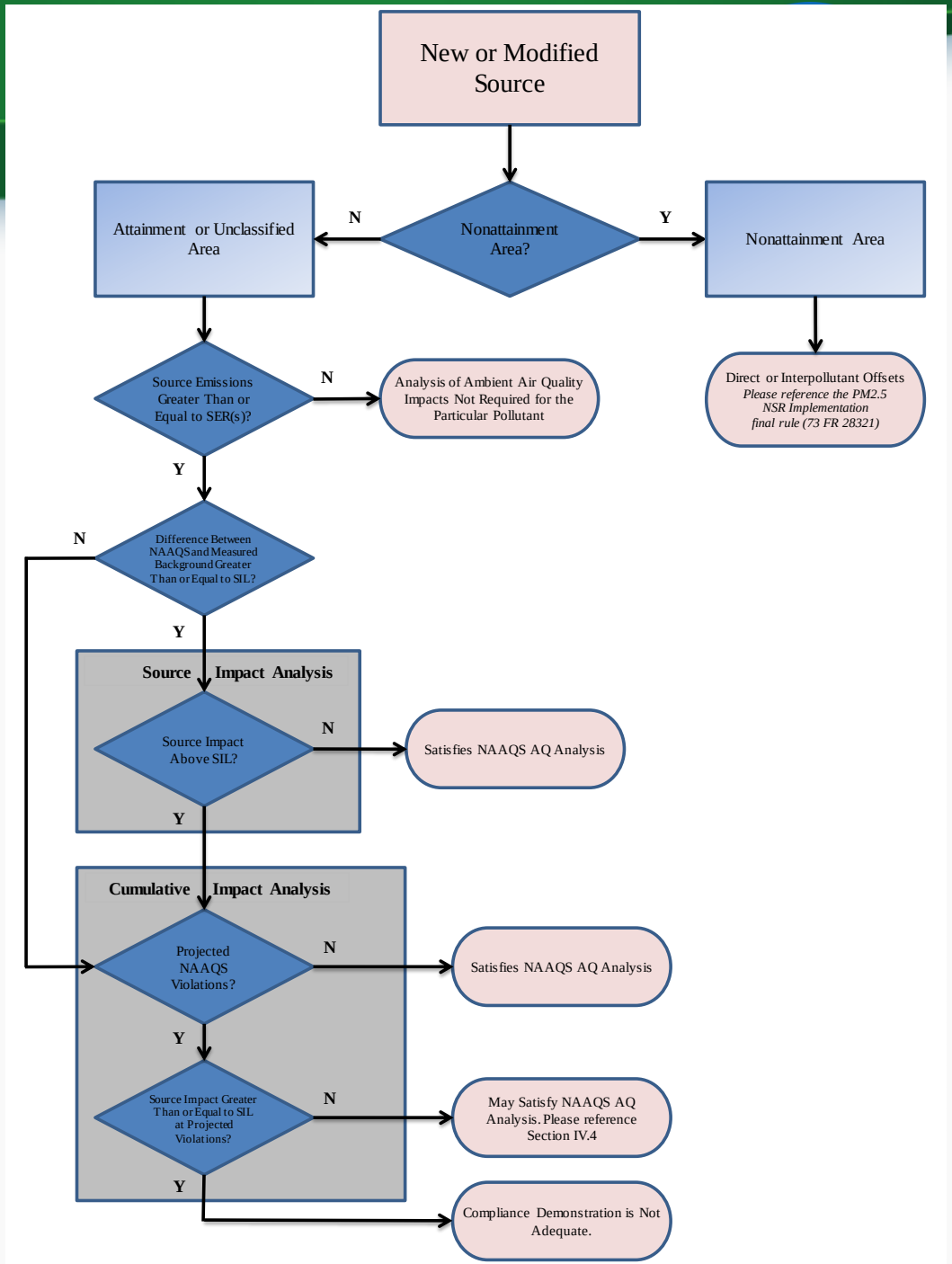
Guidance for $PM_{2.5}$ Permit Modeling

- Noteworthy changes made to the draft version include:
  - Clarifications throughout with respect to procedures for adequately addressing primary and secondarily formed $PM_{2.5}$.
  - Inclusion of an example hybrid (qualitative/quantitate) secondary $PM_{2.5}$ impact assessment based on a location representative of more typical background $PM_{2.5}$ concentrations. *(Reference Appendix D)*
  - Revision of a second tier cumulative $PM_{2.5}$ NAAQS compliance approach. *(Reference Section IV.3 and Appendix E)*
  - Revision of Section V and other sections relative to PSD Increment for $PM_{2.5}$.

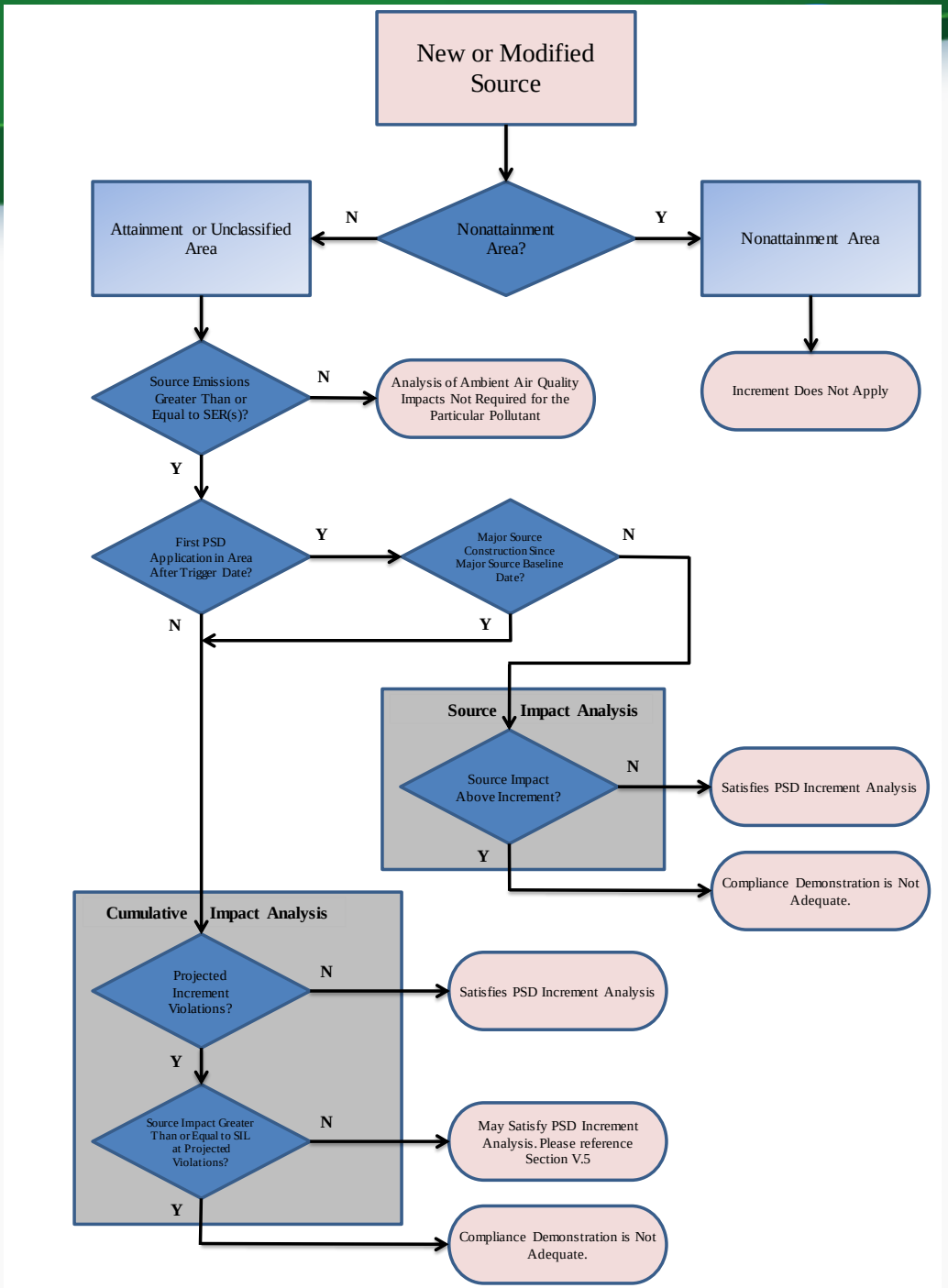
Appropriate Use of SILs

- Per the previously mentioned January 22, 2013 court decision, any permitting authority wishing to use a particular SIL value as a screening tool in a significant impact analysis should determine whether a substantial portion of the NAAQS has already been consumed.
  - Preconstruction monitoring data (or adequately representative monitoring data from an existing monitoring network) should be evaluated against the respective $PM_{2.5}$ NAAQS.
  - If the difference between the NAAQS and the measured $PM_{2.5}$ background in the area is greater than the applicable SIL value, then the EPA believes it would be sufficient in most cases for permitting authorities to conclude that a source with an impact below that SIL value will not cause a new NAAQS violation.

- Reference: Figure II-1. *(NAAQS)*



- Reference: Figure II-2. *(Increment)*



PSD Modeling of $PM_{2.5}$: Screening Nature, Consultation, & Protocol

- Given that the contributions of precursor pollutant emissions to the secondary formation of $PM_{2.5}$ are not explicitly accounted for by the currently preferred dispersion models and/or techniques and the prominent role of background concentrations in cumulative impact analyses, certain aspects of standard modeling practices used for other criteria pollutants may not be appropriate.

- As such, PSD compliance demonstrations that assess secondary $PM_{2.5}$ should be viewed as screening-level analyses analogous to the screening nature of Section 5.2.4 of Appendix W for NO_2 impacts.

$PM_{2.5}$ Compliance Demonstration: Assessment Cases

- We have established 4 different scenarios or assessment cases that further define what air quality analyses, *if any*, that an applicant would follow for compliance demonstrations of the $PM_{2.5}$ NAAQS or PSD Increments.

- Each of these 4 scenarios are outlined in the table on the following slide.

$PM_{2.5}$ Compliance Demonstration: Assessment Cases *(Continued)*

- Reference: Table III-1. *(NAAQS)* and V-2. *(Increment)*

Assessment Case	Description of Assessment Case	Primary Impacts Approach	Secondary Impacts Approach
Case 1: No Air Quality Analysis	Direct PM2.5 emissions < 10 tpy SER Both NOx and SO2 emissions < 40 tpy SER	N/A	N/A
Case 2: Primary Air Quality Impacts Only	Direct PM2.5 emissions ≥ 10 tpy SER Both NOx and SO2 emissions < 40 tpy SER	**Appendix W preferred or approved alternative dispersion model**	N/A
Case 3: Primary and Secondary Air Quality Impacts	Direct PM2.5 emissions ≥ 10 tpy SER Both NOx and/or SO2 emissions ≥ 40 tpy SER	**Appendix W preferred or approved alternative dispersion model**	• **Qualitative** • **Hybrid qualitative / quantitative** • **Full quantitative photochemical grid modeling**
Case 4: Secondary Air Quality Impacts Only	Direct PM2.5 emissions < 10 tpy SER Both NOx and/or SO2 emissions ≥ 40 tpy SER	N/A	• **Qualitative** • **Hybrid qualitative / quantitative** • **Full quantitative photochemical grid modeling**

Modeling of Directly Emitted $PM_{2.5}$

- Cases 2 & 3 both require compliance demonstration for the direct $PM_{2.5}$ through dispersion modeling.
- Typical significant impact and cumulative impact analysis approach.
- Model Selection:
  - AERMOD, *EPA's preferred near-field dispersion model.*
- Model Considerations:
  - Modeling domain.
  - Source inputs.
  - Meteorological inputs.
- Cumulative impact analyses would necessitate the inclusion of background (monitored and/or other sources explicitly modeled)

Assessment of Secondarily Formed $PM_{2.5}$

- Case 3 and 4 requires some level of assessment of precursor pollutant emissions to the secondary formation of $PM_{2.5}$.
- The assessment of the precursor pollutant emissions to the secondary formation of $PM_{2.5}$ could be completely qualitative in nature, could be a hybrid qualitative / quantitative approach, or may be a full photochemical grid modeling exercise.
- The combination of the modeled direct impacts of $PM_{2.5}$ with that of secondarily formed $PM_{2.5}$ will require additional thought and justification depending on assessment approach.
- Consultation with the appropriate permit reviewing authority is paramount, including the approval of a modeling protocol that includes a well constructed conceptual description of the $PM_{2.5}$ for the region surrounding the project source.

Revised Second Tier for 24-hour $PM_{2.5}$ NAAQS Compliance Demonstration

- The second tier method for 24-hour $PM_{2.5}$ NAAQS compliance demonstrations was proposed to provide flexibility and relieve a degree of conservativeness in the modeling that resulted from situations where background $PM_{2.5}$ concentrations peaked in seasons that were offset from the seasons to which the source $PM_{2.5}$ impacts peaked.
- The second tier methodology proposed in the draft guidance could have unintended consequences of being higher or more conservative than the first tier.

Revised Second Tier for 24-hour $PM_{2.5}$ NAAQS Compliance Demonstration *(Cont.)*

- In the final guidance, the second tier methodology was been appropriately updates to avoid unintended consequences.
  - Coordination with EPA's Office of Transportation and Air Quality (OTAQ), experience gained from interactions with industrial stakeholders, and internal testing of real-world examples of facilities in a variety of $PM_{2.5}$ environments.
- Revised second tier methodology is consistent with EPA's original SIP modeling guidance

Revised Second Tier for 24-hour $PM_{2.5}$ NAAQS Compliance Demonstration *(Cont.)*

- Recommend that the distribution of monitored data equal to and less than the annual 98th percentile be appropriately divided into seasons (or quarters) for each of the three years that are used to develop the monitored design value.
  - This results in data for each year (for three years) which contains one season (quarter) with the 98th percentile value and three seasons (quarters) with the maximum values which are less than or equal to the 98th percentile value.
  - The monitored concentrations greater than the 98th percentile in each of the three years would not be included in the seasonal (or quarterly) subsets.

Revised Second Tier for 24-hour $PM_{2.5}$ NAAQS Compliance Demonstration *(Cont.)*

- The maximum concentration from each of the seasonal (or quarterly) subsets should then be averaged across these three years of monitoring data.
- The resulting average of seasonal (or quarterly) maximums should then be included as the four seasonal background values within the AERMOD model.
- The excluded monitored concentrations are the same values that are excluded when determining the monitored design value.

Additional “Pairing” of Monitor & Model Data

- Considering the spatial and temporal variability throughout a typical modeling domain on an hourly basis and the complexities and limitations of hourly observations from the current PM2.5 ambient monitoring network, we do not recommend a "paired sums" approach on an hour-by-hour basis.
- The pairing of daily monitored background and 24-hour average modeled concentrations is not recommended except in rare cases of relatively isolated sources where the available 1-in-1 day FRM/FEM monitor can be shown to be representative of the ambient concentration levels in the areas of maximum impact from the proposed new source.

$PM_{2.5}$ Increments

- The recommendations for assessing secondary $PM_{2.5}$ impacts associated with precursor emissions on NAAQS analyses, based on the four assessment cases, are also applicable for increment analyses.

- First source into an increment impact area should be able to exercise a typical Source Impact Analysis with a minimal “headroom” checks.
  - Reference Figure II-2.

$PM_{2.5}$ Increments

- Expanded conversation on the use of monitoring to track increment (consumption and expansion) in the baseline area based on regional considerations.
  - Additional clarification will be necessary as more real-world application of using monitoring in a cumulative increment compliance demonstration is gained.

- **Early coordination** with the reviewing authority is encouraged to identify the appropriate baseline concentration and baseline area for the proposed new/modified source, and the inventory of increment-affecting sources.

Questions?

(If there is time… if not there is an open forum a bit later)